EDR Reporting Instructions for Rectangular Stacks or Ducts, with Wall Effects Adjustment

I.   Introduction

For rectangular ducts or stacks with installed flow monitors, follow the applicable reporting instructions below for EDR record types 220, 605, 606, 610, 611, 614, 615, 616, and 910, when a wall effects adjustment factor (WAF) is determined using Conditional Test Method CTM-041 and the WAF is applied to the flow rate data.

Conditional Test Method CTM-041 allows the owner or operator to either:

  C   Determine a site-specific default WAF; or

  C   Make wall effects measurements and calculate an average WAF, based on 3 or more test runs.

If you elect to measure wall effects, the measurements may be made at any load level (low, mid or high) and may either be coupled with the test runs of a flow RATA or may be made separately.   Once a default or measured WAF has been determined, you may enter it into the programming of your flow monitor as a correction to the cross-sectional area of the rectangular stack or duct, thereby adjusting the measured stack gas flow rates for wall effects. Then, when a subsequent RATA of the flow monitor is performed, the same WAF that is being used to correct the flow monitor readings should be applied to the reference method test data.

Sections II through IV, below assume that a WAF has been obtained using CTM-041 and that the WAF is being applied to the stack flow monitor readings.

II.   Reporting the WAF Information

RT 910

For each quarter in which you apply a wall effects correction factor to your flow rate data, report a series of eight to eleven supporting RTs 910. In each RT 910, report the record type code in columns 1-3, the left-justified unit or stack ID in columns 4-9, and the appropriate left-justified WAF information, beginning in column 10. The RTs 910 containing the WAF information must be reported consecutively, and the sequence must be uninterrupted. If you report any other kind of information in RT(s) 910, you must keep it separate from the WAF information by inserting a blank RT 910 above and/or below it. The WAF information for each of the required RTs 910 in the sequence is as follows:

(1) Report "RECTANGULAR   DUCT WAF"

(2) Report the width of the rectangular duct at the test location (i.e., dimension L_x in Figure 1 of CTM-041), to the nearest 0.1 ft.

(3) Report the depth of the rectangular duct at the test location (i.e., dimension L_y in Figure 1 of CTM-041), to the nearest 0.1 ft

(4) Report the WAF applied to the flow rate data, to 4 decimal places, with a leading zero (e.g., 0.9750).

(5) Indicate the WAF calculation approach, i.e., report either "D" if the WAF is a default value (using Equation 10 in CTM-041), or "T" if it is a tested value (logarithmic-assisted approach (using Equation 9 in CTM-041) or full measurement-based).

(6) Report the date on which the WAF was first applied to the flow rate data (YYYYMMDD)

(7) For full measurement-based, logarithmic-assisted, and default WAFs, report the number of Method 1 traverse points used in the WAF test run(s) 1

(8) Report the number of Method 1 traverse points used in the flow RATA runs for the most recent flow RATA.

(9) If the WAF is a measured value, report the date of the WAF test (YYYYMMDD). This record is not required if the WAF is a default value.

(10) If the WAF is a measured value, report the number of runs in the WAF test. This record is not required if the WAF is a default value.

(11) If the WAF is a measured value, report the number of test ports at which measurements were made during the WAF test runs. This record is not required if the WAF is a default value.

Report the above RTs 910 in each quarterly report, for as long as the WAF is used. If a new WAF is determined, update the information above, as appropriate. The two examples below illustrate how to report the WAF information.

Example # 1: Unit 2 is a coal-fired boiler that discharges to the atmosphere through a rectangular stack, 14 feet in width and 12 feet 6 inches in depth. A certified flow monitor is installed on the stack. A default WAF of 0.9650 is obtained using Conditional Test Method CTM-041, and a run from a flow RATA that was conducted June 1, 2004 using Method 2 with 12 Method 1 traverse points per run. This default WAF is multiplied by the rectangular duct cross-sectional area that is used to calculate the volumetric flow values reported in RT 220. The WAF is first applied to the flow rate data on January 1, 2004. (These EDRs may be resubmitted, if necessary.)

In this example, the following WAF information is required to be reported in RT 910 in the EDR reports starting in the 1st quarter of 2004 (these

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1 At least a 3 run average is required for full measurement-based and logarithmic-assisted WAFs, and 1 run is required for default WAFs.

EDRs may be   resubmitted if necessary):

9102	RECTANGULAR DUCT WAF
9102	14.0
9102	12.5
9102	0.9650
9102	D
9102	20040101
9102	12
9102	12

Report the above information in each subsequent quarterly report, for as long as the WAF continues to be applied. If a new WAF is determined, update the information appropriately and be sure to apply the new WAF to the flow monitor data.

Example 2:   Unit 3 is a coal-fired unit that has a flow monitor mounted in a rectangular duct 10 feet 4 inches in width and 8 feet 9 inches in depth. On October 15, 2004, Conditional Test Method CTM-041 is used to obtain a measured WAF. Three wall effects test runs are performed, with 12 Method 1 traverse points per run, measured at four different test ports, and an average WAF of 0.9550 is obtained. The most recent flow RATA for Unit 3 was performed on April 10, 2004, using Method 2, with 12 Method 1 traverse points per run. The measured WAF is multiplied by the rectangular duct cross-sectional area that is used to calculate the volumetric flow values reported in RT 220. This WAF is first applied to the flow monitor data on January 1, 2004.

In this example, the following WAF information is required to be reported in the EDR reports starting in the 1st quarter, 2004 (these EDRs may be resubmitted if necessary):

9103	RECTANGULAR DUCT WAF
9103	10.3
9103	8.9
9103	0.9550
9103	T
9103	20040101
9103	12
9103	12
9103	20041015
9103	3
9103	4

Report the above information in each subsequent quarterly report, for as

long as the WAF   continues to be applied. Update the information appropriately if a new WAF is determined and be sure to apply the new WAF to the flow monitor data.

III.   RATA Reporting Instructions

RT 610

The reference method and flow monitor run values reported in RT 610, columns 34 and 47 will be wall effects-adjusted flow rates. Other than this, there are no special reporting instructions are needed for RT 610. Report the RATA run information in the usual manner, according to the latest edition of the Revised EDR v 2.1 or v 2.2 Reporting Instructions.

RT 611

Follow the Revised EDR v 2.1 or v 2.2 Reporting Instructions, except for column 23:

Reference Method Used (23). Report the primary flow rate reference methods used to determine relative accuracy, using the codes below. Enter only one code per RATA. (no other codes are acceptable):

Code	Commonly Used RATA Method(s)
D2J	Method 2, With Default WAF From Conditional Test Method CTM-041
M2J	Method 2, With Measured WAF From Conditional Test Method CTM-041
2FJ	Method 2F, With WAF (either measured or default) From Conditional Test Method CTM-041
2GJ	Method 2G, With WAF (either measured or default) From Conditional Test Method CTM-041

Flow RATA Support Records─General Instructions

Report flow RATA support information, using RTs 614, 615, and 616, as follows:

C   Report RT 614 and 615 when Method 2F or 2G is used as the flow rate reference method

C   Record types 614, 615 and 616 are not required when regular Method 2 is used as the flow rate reference method

C   Table 37A, below summarizes the flow RATA support information reporting requirements

Table 37A
FLOW RATA SUPPORT RECORDS
(Rectangular Stacks or Ducts, with Wall Effects Adjustment)

Case No.	Case Description	Test Method(s) Used	Reference Method Code RT 611: 23	Required EDR Record Types		
				610 / 611	614 / 615*	616
1	Method 2 with default WAF	2 and CTM-041	D2J	Y	N	N
2	Method 2 with calculated WAF	2 and CTM-041	M2J	Y	N	N
3	Method 2F with calculated or default WAF	2F and CTM-041	2FJ	Y	Y	N
4	Method 2G with calculated or default WAF	2G and CTM-041	2GJ	Y	Y	N

*   When RTs 614 and 615 are required, report them only for RATA runs that are used in the relative accuracy calculations (i.e., run status flag in RT 610:62 = "1").

RT 614

When RT 614 is required, follow the Revised EDR v 2.1 or v 2.2 Reporting Instructions, except for the following data fields:

Flow Rate Reference Methods Used (42). Report one of the following uppercase codes to indicate which flow rate reference methods were used for the RATA.

2FJ   Method 2F, With WAF (either measured or default) from Conditional Test Method CTM-041
2GJ   Method 2G, With WAF (either measured or default) from Conditional Test Method CTM-041

This code must be the same as the code in column 23 of RT 611. Note that codes "D2J" and "M2J" do not appear on the list above. Reporting of RT 614 is not required for those

method codes.

Stack Diameter at Test Port Location (86).   Report "d", the equivalent diameter of the rectangular duct or stack (ft), as follows. Determine the <u>actual</u> cross-sectional area of the duct or stack, in ft^2; set this area equal to the area of a circle $(1/4\ \pi\ d^2)$; and solve for "d".

Stack or Duct Cross-sectional Area at Test Port (91). Report the <u>actual</u> cross-sectional area of the rectangular stack or duct at the test port location, in square feet. Do <u>not</u> adjust this cross-sectional area for wall effects.

Average Velocity for Run, Accounting for Wall Effects (103).   Leave this field blank.

Calculated Wall Effects Adjustment Factor (WAF) Derived from this Run (109). Leave this field blank.

Calculated WAF Applied to All Runs of This RATA (115). If a calculated (measured) WAF has been determined using Conditional Test Method CTM-041, and the WAF is being applied to all runs of this RATA, report the measured WAF, to 4 decimal places.

Default WAF Applied to All Runs of This RATA (121).   If a default WAF has been determined using Conditional Test Method CTM-041, and the WAF is being applied to all runs of this RATA, report the default WAF, to 4 decimal places.

Average Stack Flow Rate, Wet Basis, Adjusted if Applicable for Wall Effects (127). Determine the average stack gas flow rate (in scfh), adjusted for wall effects, using the following equation:

$$Q_{avg} = 3600\ (A_s)\ (v_{avg})\ (WAF)\ (T_{std}/T_s)\ (P_s/P_{std})$$

Where:

Q_{avg} = Average stack gas flow rate for the run, adjusted for wall effects, wet basis (scfh)

A_s =   Stack or duct cross-sectional area at the test location, from column 91 (ft^2)

v_{avg} =   Average stack gas velocity for the run, not accounting for wall effects, from column 97 (ft/sec)

WAF = Wall effects adjustment factor, from column 115 or 121 (as applicable)

T_s =   Average stack temperature ($^\circ$R)

T_{std} = Standard temperature (528 °R)

P_s = Stack pressure, i.e., sum of barometric and static pressures (in. Hg)

P_{std} = Standard pressure (29.92 in. Hg)
3600 = Conversion factor (sec/hr)

Note: The Equation above is essentially the same as Equation 25b in CTM-041, except that the flow rate is expressed in scfh, rather than scf/sec.

RT 615

When RT 615 is required, follow the Revised EDR v 2.1 or v 2.2 Reporting Instructions, except for the following data fields:

Exterior Method 1 Traverse Point Identifier (66). Leave this field blank.

Number of Wall Effects Points Used to Derive Replacement Velocity (67). Leave this field blank.

Calculated Replacement Velocity at Traverse Point, Accounting for Wall Effects (87). Leave this field blank.

RT 616

Reporting of RT 616 is not required for rectangular stacks or ducts.

IV. Flow-to-Load Ratio Test Reporting

As discussed in section I, above, when you apply a wall effects adjustment factor to the data from a stack flow monitor, the WAF is entered into the programming of the flow monitor as a correction to the stack or duct cross-sectional area. As soon as the wall effects correction is applied, the measured stack gas flow rates at a given load level will decrease, possibly by 5 percent or more. This reduction in the reported flow rates may adversely impact the quarterly flow-to-load (Q/L) ratio test, and may even cause a test failure, if the data from the most recent normal load flow RATA (i.e., the RATA on which the reference Q/L ratio is based) were not corrected for wall effects. Note that this effect is only temporary, and will disappear when the next normal load flow RATA is done and the appropriate WAF is applied to the reference method data. However, in the interim period while the effect is still present, EPA recommends the following:

C Report the reference flow-to- load ratio information in RT 605 in the usual manner. Do not attempt to make any adjustment to the reference method flow rate data recorded during the previous normal load RATA.

C Perform the quarterly flow-to-load ratio test in the usual manner and assess the impact of the wall effects adjustment that was applied to the stack flow rates.

>> If the test is passed, report the results in RT 606, in the usual manner

>> If the test is failed, you may copy your quarterly flow rate data, export it outside the DAHS environment, and remove the wall effects correction from each hourly flow rate, by dividing it by the WAF. Then, re-run the flow-to-load analysis. Report the results of the test in RT 606 and put a note in RT 910[2] indicating that the WAF was removed from the flow rate data before running the flow-to-load ratio test. Keep the results of the data analysis on-site, in a format suitable for inspection.

C In your quarterly EDR, you must report the wall effects-adjusted flow rates in columns 29 and 39 of RT 220, as measured by your flow monitor and as recorded by your DAHS, whether or not you remove the WAF from the flow rate data to perform the flow-to-load ratio test.

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[2] As discussed in section II, above, you must insert a blank RT 910 to separate this comment from the required sequence of RTs 910 communicating the rectangular stack/duct WAF-related information.